

XNBC V9: A simulation package of biological neural networks for the neurobiologist, easy to use, full featured and extensible.

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XNBC is intended to simulate biological neural networks. XNBC V9 is an important evolution of the previous versions of the XNBC package^{1,2}, a full featured application for computer naive neuroscientists.

XNBC provides several simulation models: some are based on the leaky integrator model, others on the Hodgkin-Huxley formalism. Neurons are single-compartmental neurons representing the neural trigger zone, and consequently only axo-somatic synapses are considered. The prebuilt models are a leaky integrator, an enhanced phenomenologic neuron, a phenomenologic conditional burster and several Hodgkin-Huxley type models, with up to 12 ionic currents. Nevertheless, XNBC can be extended by adding new models preably compiled and stored into a dynamically loadable shared library (modules) to be able to easily add new models of neurons, currents, etc. in order to extend the program when new knowledge emerges. Each neuron can have up to 5 different synaptic receptors types allowing 5 different synaptic currents plus a NMDA current. Receptors are sensitive to one given neurotransmitter, released at the end of the presynaptic axon. XNBC provides graphic editors for individual neuron parameters and network configuration. The network architecture, including the connection matrix and the interneuron transmission times, is built using a choice of two graphic editors (a simple one and full featured one). During the simulation many experimental actions (electrical stimulations, periodic input, background noise, drugs, etc.) can be performed, and even hybrid experiments can be performed, allowing actual biological record as input to simulated neurons. After the simulation, several programs allow to replay the simulated experiment using several types of visualizations. Quantitative data analysis can be performed in temporal or frequency domains. XNBC produces files in several formats among them, those proposed by Abeles, and used by several data analysis tools (such as Spanake, or DAN, two powerful programs³ to analyze spike trains), and gnuplot for graphs, which can be both directly launched from XNBC.

XNBC is controlled via a user-friendly interface based on XWindow, Motif (Lesstif) and GTK and produces native colour PostScript high quality graphic outputs. It was designed to be used by computer naive neurobiologists. It is also a good tool to teach neurobiology, since students can modify neuron parameters interactively, and view in real time the effect on the membrane potential and transmembrane currents.

Comparatively to the other simulation programs for neurobiologists, XNBC is very intuitive, it provides a full set of built in tools to analyze the simulation results, and to make figures. But overall, it does not need to write scripts and allows neurobiologists without programming skills to use it. This allows finally also using it for education purposes.

XNBC is written in portable ANSI C, and runs on Linux, and most Unix systems, and on Windows. XNBC is a public domain software package, distributed as an open source under the GNU GPL licence, easily installable using the classical configure/make/make install. A manual of 150+ pages is included. The XNBC home page is <http://www.b3e.jussieu.fr/xnbc/>, from which it can be downloaded (or directly from <ftp.b3e.jussieu.fr>, in the directory /pub/xnbc) as tarball source or precompiled rpm. For Windows system, an installer is provided.

References

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